

A Probable Advanced Stage of *Bathothauma lyrromma*

(Cephalopoda : Oegopsida : Cranchiidae)

BY

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(7 Text figures)

DURING AN INVESTIGATION of the extensive cephalopod collection in the Scripps Institution of Oceanography, La Jolla, California, I found two strange cranchiid specimens. Many genera and species belonging to the subfamily Taoniinae of the family Cranchiidae occur in various growth stages that have never been referable to identified adults. In examining these specimens, I have been inclined to consider that they represent a certain link connecting "larval" and "adult" stages of a taoniid. The small fin on the blunt end of the dome-like mantle and absence of a rigid "tail" suggest that they do not reach the fully mature stage, but paradoxically well-developed photogenic organs on sessile eyes and short cephalic pillar may be evidence of being already mature.

As there is neither genus nor species hitherto described and exactly referable to these specimens, identification was tentative: they are likely an advanced stage of *Bathothauma lyrromma* Chun, 1910.

Descriptions of Specimens

Bathothauma lyrromma Chun, 1910

(Figures 1 to 7)

Specimen No. 1: Male, "Circe" Expedition, Station T 1, 22 April 1968: 6°00' N; 122°36' E (near Mindanao Island, Celebes Sea). Taken by an Isaacs-Kidd Midwater Trawl, 3 000 m wire out.

Specimen No. 2: Sex unknown, Argo-Nova Leg. VI, Station 1B, 20 September 1967: 31°44'30" S; 177°15' W (near Kermadec Islands). Lodged in messenger on the Nansen bottle lowered between 1 100 and 1 220 m deep.

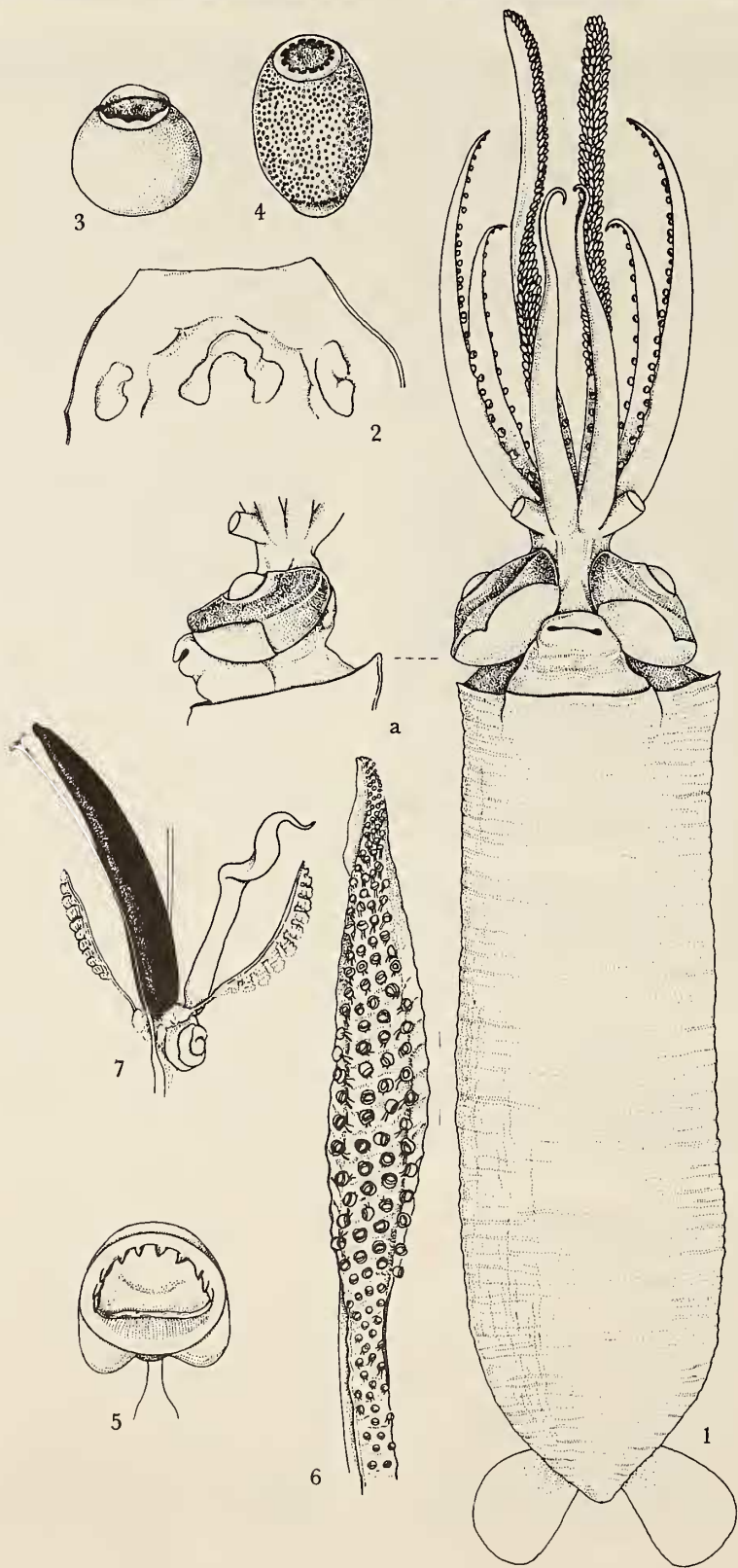
The mantle is sac-like, elongate-cylindrical in shape, with almost equal width throughout and terminating in a blunt posterior end. It is non-muscular, translucent, mem-

branous and closely wrinkled laterally and longitudinally (probably due to fixation) (Figure 1). The mantle opening is wider than the width of the head. The gladius represents a pale horn-colored streak on the posterior portion of the mantle and also posterior end, which does not form a typical lanceola. The fin is oval in outline, small, thin but rather muscular. The bases of both lobes are narrow and situated apart from each other.

The head is very narrow, weak, and has small chromatophores. The funnel is so large that it is extended anteriorly as far as to halfway of the head. The funnel organs are not well preserved. The dorsal element of the funnel organ seems to be U-shaped and has no papillae. The ventral pads are almost ovoid, but are constricted near the middle, probably due to the preserved condition.

The eye is huge in size, semi-ellipsoid. The optic vesiculae bear an opaque, pinkish, huge photogenic organ that occupies the major part of the ventro-posterior region of the eyeball. This photogenic organ is suboval in outline and has a distinct sinus on the ventral margin. The eye opening is almost oval and small.

All arms have no aboral keel and many pale chromatophores. The protective membrane is poorly developed. The arm formula is I, III, IV, II in the specimen No. 1, and III = IV, II, I in No. 2. Except for the Arm I, there are 20 - 25 pairs of suckers spacedly arranged and diminishing in size distally. The suckers of arms II, III and IV are globular in shape and their chitinous rings are smooth or bear few low teeth (Figure 3). These teeth are so low that they can hardly be called "teeth" but rather a mere undulation of the margin. On the proximal portion of Arm I there are several pairs of the same suckers as those found on the other arms. Four series of suckers of completely different type abruptly start at about $\frac{1}{5}$ of the distance from the base. The suckers of this portion are so closely set that they resemble an ear of grain. These suckers of specimen No. 1 are as large as 0.8 mm in height, but



Measurements (in mm):

	No. 1	No. 2
Dorsal mantle length	128	ca. 160
Ventral mantle length	115	—
Mantle width	54	56
Fin length	7.5	8
Fin width, both lobes taken together	36	53
Arm I	R 66 L 64	R 39 L 41
Arm II	R 40 L 42	R 48 L 46
Arm III	R 56 L 55	R 49 L 52
Arm IV	R 45 L 44	R 48 L 53
Tentacle length	—	R 175 L 166
Tentacular club length	—	R 50 L 52
Eye diameter × depth	R 17.5 × 16 L 19 × 15.5	
Sucker (largest of Arm III)	0.8 (diam.)	
Sucker (largest of Arm I)	0.6 (diam.) 0.8 (height)	

those in specimen No. 2 are very minute, almost microscopic in the distal portion. The sucker has a very short pedicel and is ellipsoid in shape. The chitinous ring on top of the sucker has 14 - 15 square-cut, spaced teeth. The lateral surface of the sucker is granulated under the microscope (Figure 4).

Both tentacles are missing in specimen No. 1. The tentacles in No. 2 are strong and have lanceolate clubs that are fringed by the protective membrane on both sides. The stem has many tiny, paired suckers that are spaced along an obsolete groove-like line running on the flattened oral surface. These suckers are continuous to the carpal group which consists of small suckers loosely arranged in 4 series, and eventually to manus suckers (Figure 6). The

suckers of the manus are long-pedicelled, cup-shaped and are arranged in 25 - 27 transverse rows in 4 columns. Their chitinous rings are half-moon shape and bear 11 to 12 sharply pointed conical teeth on the distal margin (Figure 5). There is no clear boundary with the clusters of small suckers on the dactylus. Suckers gradually diminish in size distally.

The buccal membrane is well developed and broad, and entirely smooth. The connectives attach to the dorsal sides of Arms III and IV.

The alimentary canal is very delicate and slender. The liver is large, curved, and sausage-like in shape with a tapered anterior end. The ventral side of it is the rectum ending in a pair of anal papillae. The gill is very small and delicate. The male organ is situated on the left side immediately dorso-posteriorly to the branchial heart of the left gill. The coiled testis is opaque and continues to the compressed and twisted penis that terminates in a sharp tip.

(← on facing page)

Figures 1 to 4, 7: Specimen No. 1; Figures 5, 6: Specimen No. 2

Figure 1: Ventral view of the whole animal, DML 128mm

Figure 1a: Lateral view of head

Figure 2: Funnel organs (preserved in poor condition)

Figure 3: A sucker from Arm III, 0.8mm in diameter

Figure 4: A sucker from the part of Arm I where 4 series of suckers are present, 0.8mm in height and 0.6mm in diameter

Figure 5: A sucker of manus sucker, 1.4mm in diameter

Figure 6: Club of the right tentacle, 50mm in length

Figure 7: A part of the viscera

DISCUSSION

It is a well known fact that some generic names in the Taoniinae were given to various developmental stages that have never been referred to identified adults. CLARKE (1966) proposed a scheme of arrangement of those "genera" in a parallel developmental stage. He took the

genera *Bathothauma*, *Sandalops* and *Corynomma* as the earliest stage and placed *Taonius*, *Galiteuthis*, *Phasmatopsis* (probably *Verrilliteuthis* and *Mesonychoteuthis*, too) at the most advanced or fully grown adult stages. The other taoniid "genera" could be placed somewhere between the "earliest" and the "most advanced" stages in accordance with the degree of development of some characters. The major characters based on which he arranged the taoniid "genera" are morphology of eye, arm, head and fin. The scheme of trends of development of these characters may be as follows:

Larval	—————→	Adult
Eye: with long peduncle	→ with short peduncle → sessile	
	(shoe-shaped)	(globular)
Arm: short, weak	—————→	strong
Mantle: sac-like	————→ conical ———→	elongate
Fin: small	————→ pedunculate ———→	elongate-oval
Head: with long pillar	—————→	short

Referring to the above scheme, the present specimen belongs neither to the extreme left group nor to the extreme right group. Based on the characters of sac-like mantle and small, pedunculate fins, they are likely in a rather "early" stage. Paradoxically, the huge sessile eyes with developed photogenic organs and short cephalic pillar suggest that they have already acquired "adult" characters.

Among the taoniid "genera" hitherto described, there is no "genus" exactly agreeable with the characters of the present specimens. The only "genus" characterized by a rounded mantle end and separate fins may be *Bathothauma* established by CHUN (1906, 1910). The only species in this genus is *B. lyromma* Chun, 1910.

The largest specimen of this species so far reported has a mantle length of 114mm (Voss, 1963). Concerning

discrepancies noted on Voss's specimen from other specimens described, Voss (*op. cit.*) considered that characters may change with growth, and CLARKE (1966) stated that differences show the same trends of growth described by him (*cf.* the scheme described above). The small specimens described by DESBROSSES (1938) and ALLAN (1945) differed from the larger specimens in having relatively longer eye stalks. The comments of Voss (*op. cit.*) and CLARKE (*op. cit.*) may support the view that the present specimens possibly belong to an advanced stage of *Bathothauma lyromma*, even though there has been no previous description on the metamorphoses of eyes and Arm I in this species. The function and sexual meaning of the curious Arm I is not known at present.

ACKNOWLEDGMENT

Thanks are due to Dr. John A. McGowan, Scripps Institution of Oceanography, La Jolla, California, for his kind permission to examine the curious specimens and to publish this report.

Literature Cited

- ALLAN, JOYCE K.
1940. A rare stalk-eyed squid (*Bathothauma lyromma* Chun) new to Australian waters. *Rec. Aust. Mus.* 20: 320-324.
1945. Planktonic cephalopod larvae from the eastern Australian coast. *Rec. Aust. Mus.* 21: 317-350.
- CHUN, CARL
1906. System der Cranchien. *Zool. Anz.* 31: 82-86.
1910. Die Cephalopoden. *Wiss. Ergebn. deutsch. Tiefsee-Exped. "Valdivia"* 18: 1-552.
- CLARKE, MALCOLM R.
1966. A review of the systematics and ecology of oceanic squids. *Adv. Mar. Biol.* 4: 91-300; 59 figs.
- DESBROSSES, P.
1938. Cephalopodes pêchés au cours de la cinquième croisière. *Rev. Trav. Off. (scient. tech.) Pêch. marit.* 11: 335-347.
- VOSS, GILBERT L.
1963. Cephalopods of the Philippine Islands. *Bull. U. S. Nat. Mus.* 234: i-v+1-180; 35 text figs.

